New species of *Gorgoderina* (Digenea; Gorgoderidae) and other helminths in *Euphlyctis cyanophlyctis* (Anura: Dicroglossidae) from Dehradun, (Uttarakhand), India

Charles R. Bursey1* Anjum N. Rizvi2 and Pallab Maity2

1Department of Biology, Pennsylvania State University, Shenango Campus, Sharon, Pennsylvania 16146, USA; 2Zoological Survey of India, Northern Regional Centre, Dehradun-248 195, Uttarakhand, India

Abstract

*Gorgoderina spinosa* sp. nov. (Digenea, Gorgoderidae) from the bladder of the water skipper, *Euphlyctis cyanophlyctis* (Anura, Dicroglossidae), from Dehradun, India is described and illustrated. *Gorgoderina spinosa* is the 6th Indian species assigned to the genus and is separated from its congeners based upon the morphology of vitelline glands and the presence of a spinose integument. Two additional digenean species, *Diplodiscus amphichrus* and *Ganeo tigrinus*, and 3 nematode species, *Cosmocerca kalesari*, *Gendria chauhani*, and unidentified larvae were found. *Diplodiscus amphichrus*, *Ganeo tigrinus*, *Cosmocerca kalesari*, and *Gendria chauhani* have previously been reported to infect Indian individuals of *Euphlyctis cyanophlyctis*.

Keywords

*Gorgoderina spinosa* sp. nov. Digenea, *Diplodiscus amphichrus*, *Ganeo tigrinus*, *Cosmocerca kalesari*, *Gendria chauhani*, Nematoda, India

Introduction

The water skipper, *Euphlyctis cyanophlyctis* (Schneider, 1799), occurs from southeastern Iran, southern Afghanistan, Pakistan (except the far north), Nepal (lower elevations), southern Bhutan and eastern India through Bangladesh and northeastern India to extreme western Myanmar, Sir Lanka, Malaya and Minh Hai Province, Vietnam (Frost, 2014). During a helminthological examination of 17 specimens of *E. cyanophlyctis* collected in Dehradun, India, 1 was found to harbour 4 individuals of a previously undescribed species of *Gorgoderina* Looss, 1902 as well as individuals of the digeneans, *Diplodiscus amphichrus* and *Ganeo tigrinus*, and the nematodes, *Cosmocerca kalesari* and *Gendria chauhani* and an unidentified larval form (Table 1). Of the 55 species of *Gorgoderina* found worldwide (Mata-López *et al.*, 2005), 5 are known from Indian amphibian hosts, *G. carli* Baer, 1930, *G. ellipticum* Dwivedi 1968, *G. infundibulata* Dwivedi 1968, *G. symmetricorchis* Dwivedi 1968, and *G. guptai* Jahan, 1973. The purpose of this paper is to describe the 6th species from India assigned to *Gorgoderina*, to provide prevalence of other helminths collected from these hosts and to revise the parasite list of *E. cyanophlyctis*.

Materials and Methods

Specimens of *Euphlyctis cyanophlyctis* were collected by water net. Frogs were brought live to the laboratory and pithed, the body cavity was opened by a longitudinal lateral incision and the gastrointestinal tract was removed. The oesophagus, lungs, stomach, small intestine and large intestine were examined separately for helminths. Both digeneans and nematodes were found. Each digenean was removed, washed, slightly coverslip pressed and fixed in AFA (alcohol-formalin-acetic acid), stained with Semichon’s carmine, dehydrated and mounted in Canada balsam. Each nematode was removed, fixed in formalin, dehydrated in glycerin alcohol and examined in wax sealed slides. Subsequently, they were studied and photomicrographed with a BX51 DIC/BF Olympus research microscope with DP20 digital camera from which the illus-
New species of *Gorgoderina*

Table 1. Number of helminths found (N), prevalence as percentage, mean intensity (X ± 1SD) and range for helminths from *Euphylyctis cyanophlyctis* collected in Village Budhna, Dehradun, India

<table>
<thead>
<tr>
<th>Trematoda</th>
<th>Number</th>
<th>Prevalence</th>
<th>Mean intensity (range)</th>
<th>ZSI/NRC/ Reg. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diplodiscus amphichrus</td>
<td>5</td>
<td>4/17 (24%)</td>
<td>1.3 ± 0.5 (1-2)</td>
<td>ZSI/NRC/IV.1033</td>
</tr>
<tr>
<td>Ganeo tigrinus</td>
<td>31</td>
<td>8/17 (47%)</td>
<td>3.9 ± 3.0 (1-10)</td>
<td>ZSI/NRC/IV.1032</td>
</tr>
<tr>
<td>Gorgoderina spinosa sp. nov.</td>
<td>4</td>
<td>1/17 (6%)</td>
<td>4</td>
<td>ZSI/NRC/IV.1030 &amp; 1031</td>
</tr>
<tr>
<td>Nematoda</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cosmocerca kalesari</td>
<td>2</td>
<td>1/17 (6%)</td>
<td>2</td>
<td>ZSI/NRC/IV.1035</td>
</tr>
<tr>
<td>Gendria chauhani</td>
<td>12</td>
<td>4/17 (24%)</td>
<td>3.0 ± 1.4 (2-5)</td>
<td>ZSI/NRC/IV.1034</td>
</tr>
<tr>
<td>Unidentified larvae</td>
<td>14</td>
<td>6/17 (35%)</td>
<td>2.3 ± 2.2 (1-6)</td>
<td>ZSI/NRC/IV.UC1</td>
</tr>
</tbody>
</table>

**Results**

Forty digeneans also representing 3 species and 28 nematodes also representing 3 species were collected (Table 1). Of the digeneans, 4 individuals represented an undescribed species of *Gorgoderina*. A description of the new species follows.

**Description**

*Gorgoderina* Looss, 1902

*Gorgoderina spinosa* sp. nov. (Fig 1)


**Taxonomic summary**

Type host: Water skipper frog, *Euphlyctis cyanophlyctis* (Schneider, 1799); symbiotype, ZSI/NRC/F.C.1/25/x/13.

Type Locality: Village Budhna, Lakhwad Range, Dehradun, Latitude: N = 30°29.317´E = 077°52.923´, elevation 612 m.

Site of infection: Intestine.

Type specimens: Holotype, ZSI/NRC/IV.1030; Paratype ZSI/NRC/IV.1031 (Zoological Survey of India Northern Regional Centre, Dehradun).
Etymology: The new species is named after the distinctive spinose tegument.

Remarks

Five species of Gorgoderina have been described from amphibians of India. Baer (1930) described G. carli from the caecilians Uraeotyphlus oxyurus and Ichthyophis orthoplicatus. Dwivedi (1968) described two species, G. symmetriorchis from Rana limnocharis (currently Fejerarya limnocharis) and G. infundibulata from Bufo melanostictus (currently Duttaphrynus melanostictus). Jahan (1973) described G. guptai from Bufo sp., probably a renaming of G. indica Gupta and Jahan, 1971, a species from the same host and locality but described only in an abstract (Gupta and Jahan, 1971). Gorgoderina spinosa sp. nov. is most similar to G. ellipticum in that both species have similar body shapes, narrow anterior and tapering posterior end, maximum width in their immediate post-equatorial region; the other 4 species have elongate body shapes. Gorgoderina spinosa sp. nov. differs from G. ellipticum in smaller body length (1.60–1.95 vs. 4.69–5.72), position of ovary (above left testis vs. above right testis) and integument (spinous vs. aspinous). A key to the Indian species of Gorgoderina is provided in Table II.

Table II: Key to the Indian species of Gorgoderina

| 1a. Vitelline glands entire | .................................................................................................................................................................................2 |
| b. Vitelline glands lobed | ........................................................................................................................................................................... |
| 2a. Integument spinous | ........................................................................................................................................................................... |
| b. Integument aspinous | ................................................................................................................................................ | G. spinosa sp. nov. |
| 3a. Body spatulate | ........................................................................................................................................................ | G. ellipticum Dwivedi, 1968 |
| b. Body elongate | ............................................................................................................................................................................................ 4 |
| 4a. Testes opposite | ........................................................................................................................................................ | G. symmetriorchis Dwivedi, 1968 |
| b. Testes oblique | ............................................................................................................................................................................................ 5 |
| 5a. Testes irregularly lobed, unequal in size | ................................................................................................................................................................................. |
| b. Testes unlobed, equal in size | ................................................................................................................................................................................. |

Fig. 2. Unidentified nematode larvae. A – entire. B – anterior end, teeth. C – tail
Discussions

Tubangui (1933) described Diplodiscus amphiarius from Philippine frogs (Rana spp.); 2 subspecies, D. a. brevis Nama and Khichi, 1973 and D. a. mungus Srivastava, 1934, have been described from Rana cyanophlyctis collected in India and D. sinicus Li, 1937 described from Fejervarya limnocharis collected in China is considered a synonym. Diplodiscus amphiarius has been reported from many localities across India; additional hosts include Chirinxus vittatus, Hoplobatrachus tigrinus, Polyedepates leucomystax, Rhacophorus maximus, and unidentified species of Bufo and Rana (Agarwall, 1966; Mukherjee and Ghosh, 1972; Nama and Khichi, 1973; Pandey, 1969; Singh, 1977, Tandon et al., 2001; Imkongwangpang et al., 2014).

Ganeo tigrinus was described by Mehra and Negi (1928) from Hoplobatrachus tigrinus collected in Allahabad, India and has been reported from other regions of India; additional hosts include H. crassus, Fejervarya limnocharis, Polyedepates leucomystax, and unidentified species of Bufo, Fejervarya, and Rana (Mukherjee and Ghosh, 1970, 1972; Imkongwangpang et al., 2014).

Cosmocerca kalesari was described from Euphlyctis cyanophlyctis collected in Haryana, India by Rizvi et al. (2011). To our knowledge, this is the second report of C. kalesari and it is currently known only from E. cyanophlyctis.

Gendra chauhani was described from Euphlyctis cyanophlyctis collected in Jodhpur, India by Nama (1975). To our knowledge, this is the second report of G. chauhani and it is currently known only from E. cyanophlyctis.

Nematode larvae were collected from the lungs of 6 hosts (Fig. 2a). The mid-region of the body is cylindrical, tapering both anteriorly and posteriorly. The length of the body varies from 16.43 to 25.70 mm and the maximum width at mid body ranges from 400 to 800. The larvae are distinguished by a claviform esophagus (2.28 to 3.18 mm in length), divisible into a muscular pharynx approximately 335 to 450 in length and a glandular corpus approximately 1170 to 2810 in length. The anterior end of the pharynx is armed with 3 pair of teeth (Fig. 2b). The tail is 175 to 315 in length and terminates in a short flexible filament (Fig. 2c). The shape of the esophagus, presence of pharyngeal teeth and the location of larvae in the lungs suggest to us a member of the Strongyloidae Chitwood and Mcintosh, 1934. However, additional hosts will need to be examined before the identity of these larvae can be ascertained.

Acknowledgements. Our thanks to the Director, Dr. K. Venkataraman, Zoological Survey of India (ZSI), Kolkata, for facilities and encouragement.

References

Mehra H.R., Negi P.S. 1928. Trematode parasites on the Pleurogenetinae from Rana tigrina, with a revision and synopsis of the subfamily. Alahabad University Studies, 4:63–118.

Received: April 18, 2014
Revised: May 5, 2014
Accepted for publication: June 27, 2014